

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 May 2001 (03.05.2001)

PCT

(10) International Publication Number
WO 01/31562 A1

(51) International Patent Classification?: **G06K 9/00, G06F 3/00**

(21) International Application Number: **PCT/GB00/03913**

(22) International Filing Date: **12 October 2000 (12.10.2000)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:
9925587.9 28 October 1999 (28.10.1999) GB
9929757.4 17 December 1999 (17.12.1999) GB

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(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

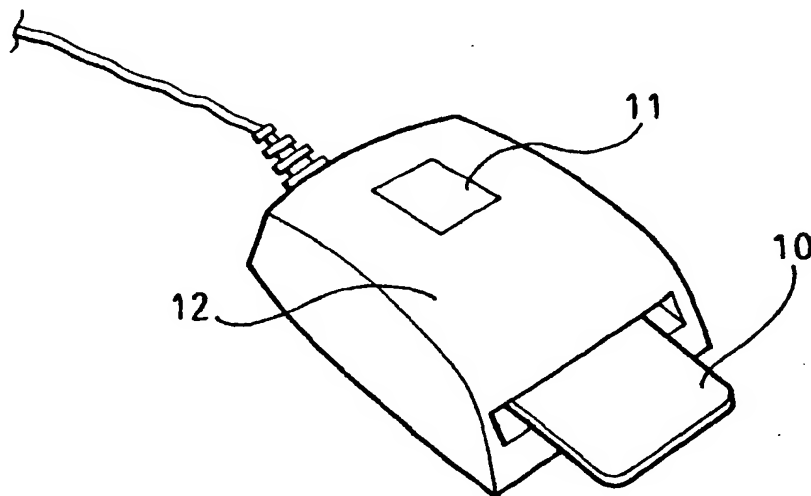
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **IDENTIFICATION SYSTEM**



(57) Abstract: An identification system for use in controlling the operation of a device comprises comparing fingerprint data with stored data to identify both an individual and which of the individual's fingerprints has been input, and using the identity of the individual and the finger in controlling the operation of the device.

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"Identification System"

This invention relates to an identification system for use in identifying an individual.

It is well known to use fingerprints in the identification of people. For example
5 fingerprint records have been used by the police around the world to identify individuals.

It is also known to use electronic fingerprint recognition systems to control access rights in computer systems, the computer holding a database of fingerprints of authorised users and only permitting use of the computer or certain operations of the computer by individuals whose fingerprint match one of the fingerprints stored in the database.
10 Typically, only one fingerprint of each authorised user is stored.

The present invention is intended to provide an identification system having an improved level of security.

According to the invention there is provided an identification system for use in controlling the operation of a device comprising sensing the fingerprint of a finger of an
15 individual, comparing the fingerprint with a series of stored fingerprints to identify both the individual and which of the individual's fingerprints has been sensed, and using both of these pieces of information in controlling the operation of the device.

One possible use of the invention is in controlling the operation of a television. Each television channel is allocated to one of a user's fingers, and the television channel
20 to be viewed may be selected by placing the appropriate one of an individual's fingers onto a fingerprint reader. For example, channel one may be selected using one finger, channel two being selected using another finger. Where there are a large number of

channels, then these may be selected by using appropriate fingers in sequence. As both the individual and the finger being used are identified, the television may be programmed to restrict access to some channels to a restricted group of authorised viewers, or alternatively some other settings of the television may be set to those preferred by that individual.

An alternative use for the invention is in logging on to a computer system with a range of access rights. As the system identifies both the user and which finger is being used, the system may be set up so that the use of one finger gives the individual a restricted level of access, the use of a different finger gives additional access rights, and the use of a third finger gives further access rights. Again, as the identity of the user is checked, access to certain areas can be restricted to smaller groups of authorised users.

In a further possible application, the input fingerprint data could be transmitted to a remote location where the identification process is performed and a device controlled in response to the fingerprint data being recognised. The fingerprint data would then be acting, in effect, as an electronic signature. Clearly, if the device at the remote location requires several fingerprints to be entered in a particular sequence, then the system is of a good level of security.

Another use for the invention is in a trigger mechanism for a gun. The system would only permit firing of the gun by an authorised individual. Further, the firing action of the gun may be controlled depending upon which of the individual's finger is placed upon the trigger. Thus, when used at close range or when used to stun rather than injure, a different finger may be used to that used when the gun is to be used to injure,

resulting in the gun operating at a reduced power level. The system could also be used with other devices incorporating switches, the function of the switch depending upon which individual is using the switch and which of the individual's fingers is being used.

The system could alternatively be used in an access system having a duress
5 warning system. In normal use, one of the user's fingers is used to gain access, for example to a computer system, the use of another of the user's fingers also gaining access, possibly at a restricted level, and also triggering an alarm or warning that the user has been forced to use the system under duress.

Another use for the system is where devices must be operated, either in areas of
10 poor light or by the blind. In such cases, the use of a traditional key pad or control panel having buttons may be impractical, and instead the device may be operated by sensing which of an individual's fingers has been placed on a fingerprint reader, and associating a function with each finger. Alternatively a number may be associated with each finger thereby permitting numbers to be entered. Clearly, number codes or large numbers may
15 be input by placing the appropriate fingers onto the fingerprint reader in sequence.

The system may require two or more fingerprints to be input in sequence, the system determining whether the fingerprints have been input in a correct sequence and controlling operation of the device accordingly. In such an arrangement access rights are only granted when the fingerprints have been input in the correct sequence, thereby
20 introducing an additional level of security.

Another use for the invention is for text entry on keyboards having only a small number of keys, for example on mobile telephones where names or text messages are to

be entered for storage in an address book or for transmitting in the form of a text message, E-mail, or facsimile transmission. Each key may have several functions associated therewith, the function to be performed depending upon which of an individual's fingers are used to depress or operate the key. Although referred to herein
5 as "keys", it will be appreciated that each "key" may simply comprise part of a larger sensor area divided to define a plurality of "keys".

In the description hereinbefore the fingerprint data relating to several fingers are input sequentially. It will be appreciated, however, that another option is for fingerprint data relating to several fingers may be input at the same time.

10 As described hereinbefore, the input data may be used to perform operations or actions, to act as authorisations or access level authorisations, to set modes, provide outputs, or to deny access or inhibit certain actions or operations. If desired, control may be achieved in conjunction with other inputs, for example data input through a keyboard or other device, and the control may interact with a computer program.

15 It will be appreciated that in all of the arrangements mentioned hereinbefore, as the system must identify which of an operator's fingers is being used to operate the device, and as fingerprints provide an accurate technique for identifying individuals, the system automatically identifies the individual operating the device.

The invention will further be described, by way of example, with reference to the
20 accompanying drawings, in which:

Figures 1 and 2 are views indicating possible codes associated with the fingers of a user's hands;

Figure 3 is a view of a fingerprint reader suitable for use with the invention; and

Figure 4 is a view of a key pad suitable for use with the invention.

As described hereinbefore, the invention is suitable for use in a wide range of applications. One possible application is in the inputting of numeric codes. As
5 illustrated in Figures 1 and 2, an individual's fingers have been allocated the digits 0 to 9. The fingerprints of all of the individual's fingers have been stored upon a smart card 10 (as illustrated in Figure 3), or within a computer memory using a suitable fingerprint reader and an appropriate recording device.

In use, when the individual wishes to input a numeric code, he simply places the
10 appropriate ones of his fingers, in sequence, onto the sensor 11 of a fingerprint reader 12. In Figure 3, the fingerprint reader 12 comprises a Biometrics Research Precise 100sc ID, but it will be appreciated that other readers could be used. The reader 12 is used, in conjunction with the stored fingerprint data, to identify the individual and to identify which of his fingers have been placed upon the sensor 11. Provided the reader
15 or a device connected to the reader 12 is programmed in such a manner as to associate the correct digit with each finger, then the information input through the reader 12 can be used to denote a numeric code.

By way of example, where the code 284 is to be entered, then the fingerprints
of right hand finger 2, left hand finger 4 and then right hand finger 4 should be placed
20 upon the sensor 11 of the reader 12 in sequence.

If desired, the identification process may be performed at a remote location and used to control a device at that location, the input fingerprint data acting, in effect, as

an electronic signature. The invention may be suitable for use in electronic banking systems for example.

As both the identity of the individual and the sequence in which the digits of the code are entered are recognised by the identification system, the system provides an identification system having an improved level of security over both systems that simply require the input of an identification number and over systems that use a single fingerprint to identify an individual. Although in the description hereinbefore a numeric code is input, it will be appreciated that this need not be the case, and that all that is required is that the fingerprints are input in the correct sequence. However, the allocation of numeric digits to the fingers may be advantageous, particularly where the device requires the input of numeric information, in that subsequent operation of the device may be achieved without providing a numeric key pad. The invention may, therefore, be suitable for use in, for example, an automatic bank teller machine. The avoidance of the provision of a numeric key pad may be advantageous in that the cost of the device can be reduced, the risk of damage may be reduced and operation of the device in areas of poor lighting or by the visually impaired may be simplified as individual keys do not need to be depressed but rather a fingerprint input on a reader which may be of relative large dimensions.

The advantages mentioned above with regard to the avoidance of the provision of a key pad, use in areas of poor lighting or where the device is to be used by the visually impaired may be applicable in a wide range of other devices.

Although in the description hereinbefore, a number of fingerprints are input in

a predetermined sequence in order to gain control of a device, this need not be the case. Instead, control of a device may be achieved by inputting a single fingerprint, the device being controlled in accordance with which of the individuals fingerprints are input. By way of example, instead of typing a password to log onto a computer system the
5 identification system may be used. The system may be set up so that inputting of one fingerprint permits use of a local computer. Subsequent input of another fingerprint may allow use of a local area network and subsequent input of another fingerprint may permit internet access. In all three cases, the identity of the individual is determined and access denied if the individual is not recognised or not permitted the particular level of access.

10 The system may alternatively be used to provide a warning in the event that a user is being forced to log onto a computer system or access other rights under duress. The system could operate in such a manner that placing one finger onto a fingerprint reader allows the user normal access, the use of another finger granting access rights, possibly at a reduced level, and also triggering an alarm or warning that the access rights
15 have been obtained under duress. It is thought that a user is more likely to trigger the warning under such circumstances using the system of the invention than to trigger a warning using a conventional second password technique.

In an alternative application, the system could be used to control the operation of a television, controlling which channel is selected. Each television channel is allocated
20 to a finger and the channel selected by inputting that finger's print. As the identity of the individual selecting the channel is determined, access to certain television channels may be restricted to only some of the authorised users of the television. Where the number

of television channels exceeds ten, then higher numbers may be input by inputting fingerprints in sequence as described hereinbefore.

A further use for the invention is in restricting the use of a gun and controlling the operation of the gun. This may be achieved by associating a fingerprint reader with the trigger of the gun, and controlling the trigger in such a manner as to ensure that the gun can only be fired when an authorised user's fingerprint is sensed, detection of any other fingerprint disabling the gun. Clearly, the use of the invention reduces the risk of injury arising from accidental operation of the gun and prevents use of the gun other than by the authorised user. Additionally, as according to the invention several fingerprints of a user are stored and the finger used to operate the device is identified, the gun may be arranged such that when the trigger is operated by the authorised user using his index finger, the gun is fired at full power, the power being reduced when another finger is used. As a result, the gun can be operated in such a manner as to either stun or injure, or may be operated in such a manner as to reduce the risk of injury of bystanders by reducing the range of the gun.

Another use for the invention will be described with reference to Figure 4. Figure 4 illustrates, diagrammatically, the key pad of a mobile telephone. The key pad has ten number entry keys or key pad areas 14. Each key comprises a fingerprint reader. Each key 14 has a numeric digit associated therewith. Additionally, some of the keys 14 have letters associated therewith. For example, the key 14 associated with the digit 1 also has the letters A, B and C associated therewith. The key pad further has a mode selection key 15 which is used to determine whether the key pad is to operate in text

entry mode or in a number entry mode. The key pad also includes several other keys 16 which can be used to perform a range of functions, for example to permit a range of symbols to be entered or to permit the key pad to be operated in a calculator mode. The symbols which could be input include brackets, mathematical symbols and symbols used
5 where text is to be input other than in the English language. As illustrated in Figure 14, some of the symbols may also be associated with the key 14 associated with the digit O.

In use, when operating in the number entry mode, the key pad is used in the normal manner. In order to enter text, the mode selection key 15 is operated. Once in the text entry mode, each key 14 has several possible functions and which function is
10 performed depends upon which finger is used to operate the key. For example, if it is desired to input a letter A, then the key 14 associated with digit 1 is operated using the index finger. To enter a letter B, rather than use the index finger, the middle finger is used.

After text entry has been completed, or if a number needs to be inserted, then the
15 mode selection key 15 is operated to revert to number entry mode.

The key pad may be made up of a plurality of separate discrete fingerprint sensors, each sensor constituting one of the keys 14 as mentioned above. Alternatively, a single large fingerprint sensor may be used, the sensor being divided into a plurality of regions or zones, each zone forming one of the keys.

20 The use of the invention in this manner is advantageous in that text entry on a key pad having few keys can be achieved in a convenient manner. Further, as the individual operating the device is identified, use by an unauthorised individual can be

prevented.

Although described in relation to a mobile telephone, the invention is also applicable to other devices, for example electronic organisers.

In the description hereinbefore, only data representative of a single fingerprint
5 is input at a given time, if desired several fingerprints being entered in sequence. It will
be appreciated that data representative of several fingerprints could be input at the same
time. The data may, if desired, be used in conjunction with other information, for
example data derived from another input device (e.g. a keyboard) or from a computer
program, in controlling the operation of the device. The manner in which control is
10 achieved may, for example, cause actions or operations to be performed or inhibited,
provide outputs, set modes, or provide or deny authorisations or access level
authorisations.

CLAIMS

1. An identification system for use in controlling the operation of a device comprising comparing fingerprint data from a fingerprint reader with stored fingerprints to identify the individual whose fingerprint data has been input and to identify which of
5 the individual's fingerprints has been input, and using the data representative of both the identity of the individual and of the finger in controlling the operation of the device.
2. A system as claimed in Claim 1, wherein the device comprises a computer system and the data representative of the identity of the individual and of the finger are used in controlling access rights.
- 10 3. A system as claimed in Claim 1, wherein the device comprises a trigger mechanism of a gun and the data representative of the identity of the individual and the finger are used to determine whether to render the trigger mechanism operative and to control an operating parameter of the gun.
4. A system as claimed in Claim 1, wherein the device comprises a switch
15 mechanism and the data representative of the identity of the individual and the finger are used to determine how the switch mechanism operates and/or what is controlled by the switch mechanism.
5. A system as claimed in Claim 1, further comprising repeating the step of comparing using fresh fingerprint data and comparing the order in which the fingerprint
20 data was input with a stored sequence.
6. A system as claimed in Claim 1, further comprising allocating a numeric digit to each of an individual's fingers, and using the system to input a number.

7. A system as claimed in Claim 6, wherein the step of comparing is repeated at least once using fresh fingerprint data to permit a multi-digit number or numeric sequence to be input.
8. A system as claimed in Claim 1, wherein the device includes a plurality of sensor regions, each sensor region having a plurality of functions associated therewith, the function performed by the device depending upon the finger used to operate the device and which sensor region is used to input the fingerprint.
9. A system is claimed in Claim 8, wherein the device is adapted to permit text entry, the letter entered depending upon which finger is used and which sensor region is used to sense the fingerprint.
10. A system as claimed in Claim 8, wherein said sensor regions of said plurality of sensor regions are used singly or in combination in performing one or more of said plurality of functions associated with said each of sensor regions, said performing of said one or more of said plurality of functions including performing one or more actions, action authorisations, access level authorisations, setting of operating modes, and providing one or more outputs or denying such authorisations, setting of modes, or the performance of actions.
11. A system as claimed in Claim 8, or Claim 10, wherein said system interacts with other input to perform one or more of said plurality of functions associated with said each of sensor regions.
12. A system as claimed in Claim 11, wherein said other input includes input from a keyboard or alphanumeric input device.

13. A system as claimed in Claim 11 or Claim 12, wherein the system further interacts with stored information in controlling the device.
14. A system as claimed in any one of Claims 11 to 13 wherein the system further interacts with a program in controlling the device.
- 5 15. An identification system substantially as hereinbefore described with reference to any one of the accompanying drawings.
16. An input device comprising an array of fingerprint sensor regions, the input device outputting signals dependant upon which of a user's fingers is used and which sensor region is used at a given time.

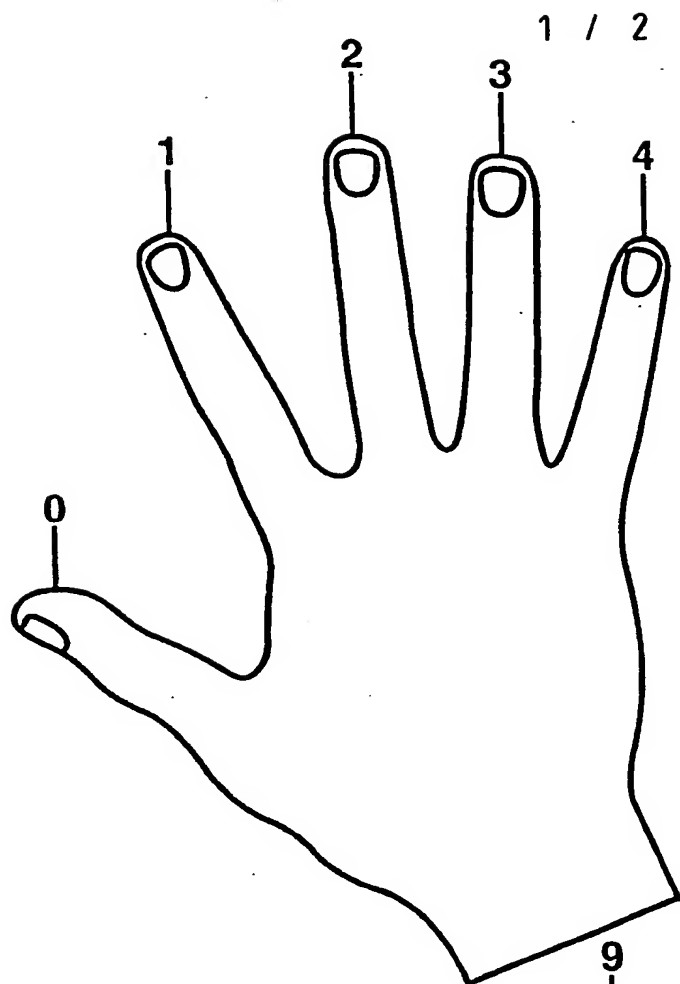
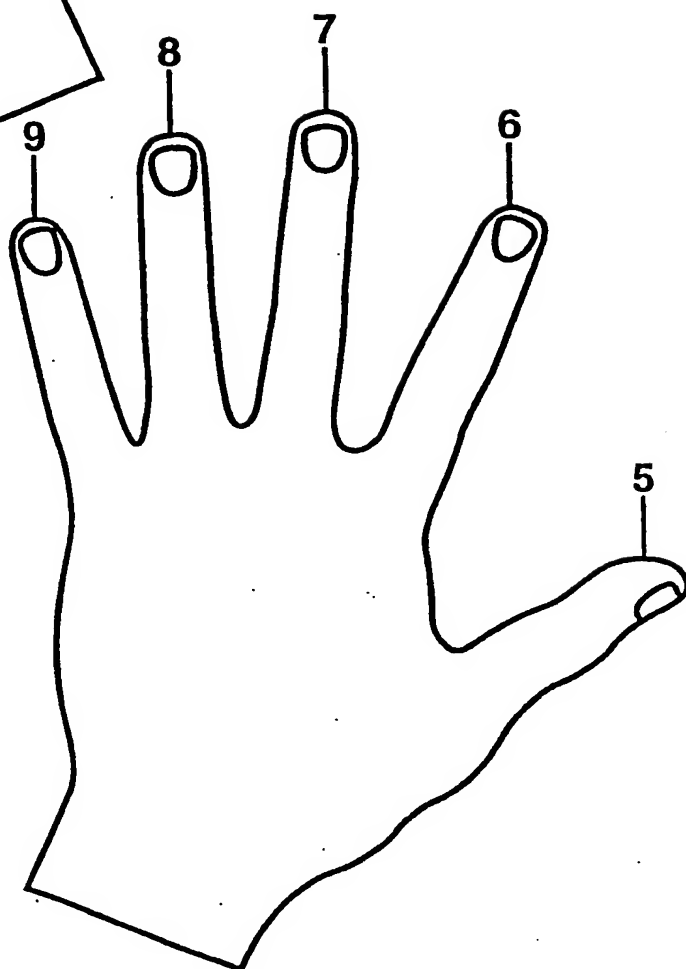
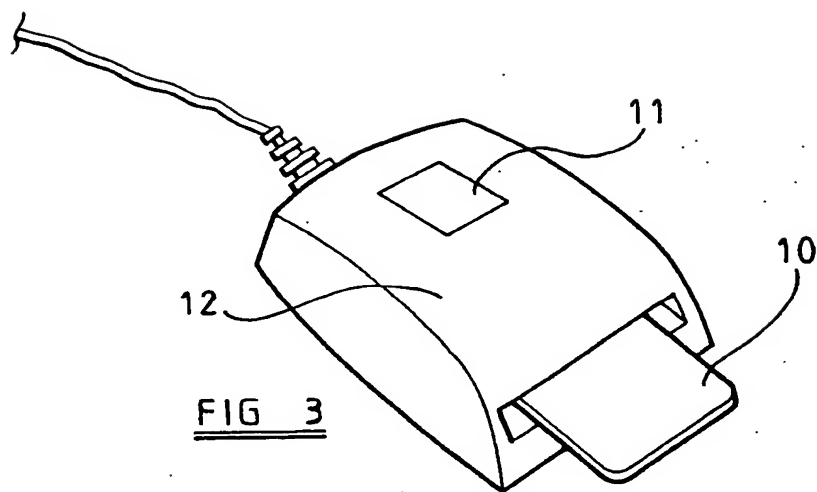
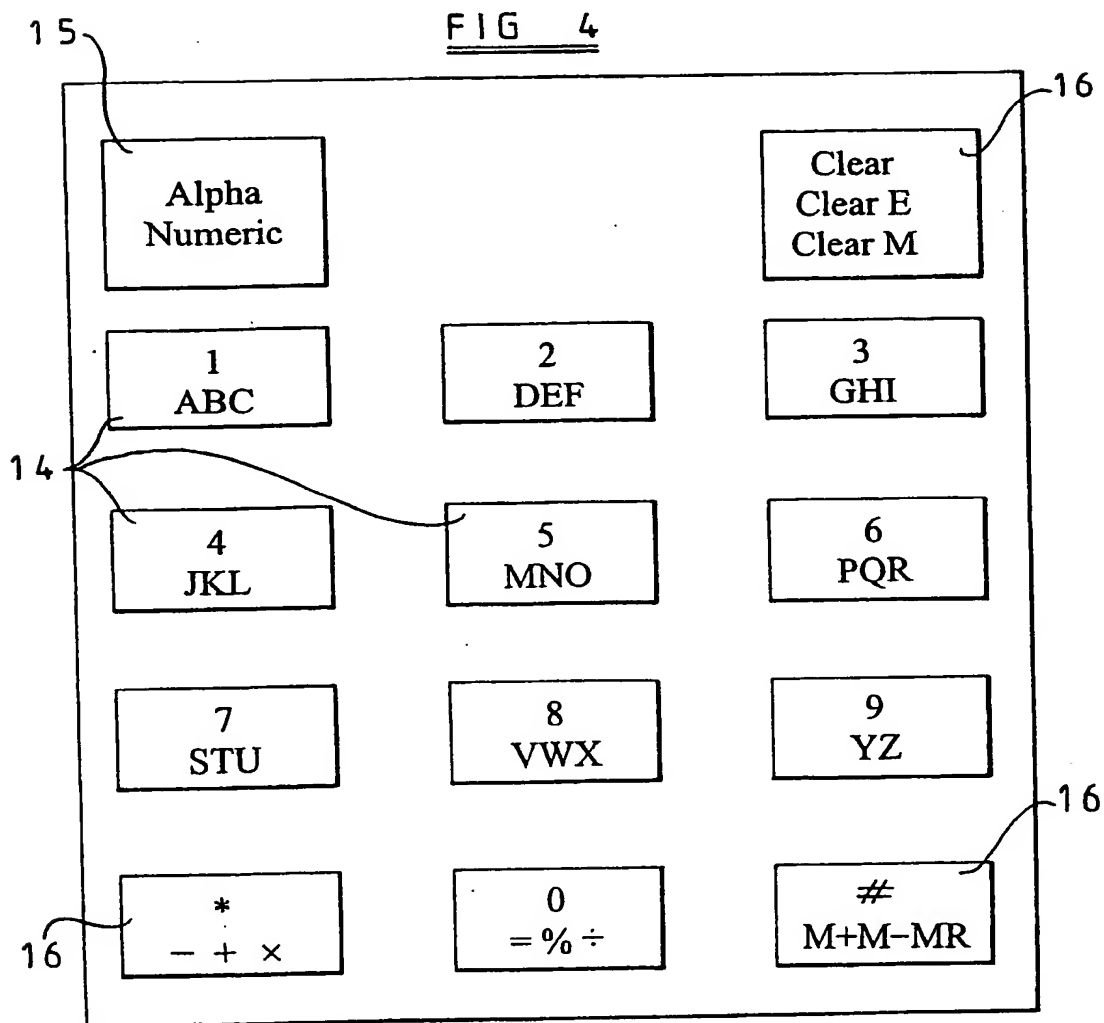


FIG 1

FIG 2



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FIG 3

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03913

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K9/00 G06F3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06K G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

INSPEC, WPI Data, IBM-TDB, PAJ, EPO-Internal, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 812 252 A (BOWKER J KENT ET AL) 22 September 1998 (1998-09-22) abstract; figures 1,17-23 ----	1-4
A	EP 0 949 578 A (NIPPON ELECTRIC CO) 13 October 1999 (1999-10-13) abstract; figure 2 ----	1-16
A	FR 2 585 153 A (DESGORCES JEAN) 23 January 1987 (1987-01-23) the whole document ----	1-16
A	WO 98 40962 A (KONINKL PHILIPS ELECTRONICS NV ;PHILIPS NORDEN AB (SE)) 17 September 1998 (1998-09-17) page 13, line 27 - line 28; figure 1 -----	16

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

27 February 2001

Date of mailing of the international search report

07/03/2001

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/03913

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